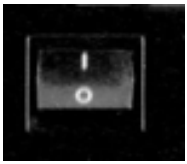
Operating instructions

Controller C 30 / S 30

Read the operating manual before commissioning the Controller.

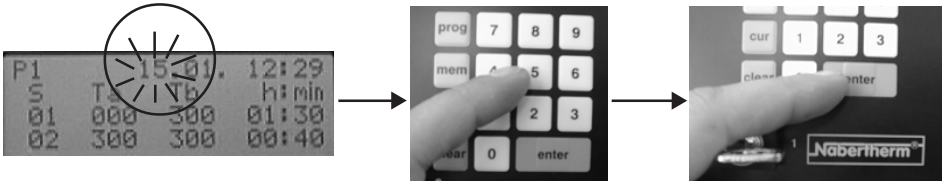
Short instructions

Switching on the controller

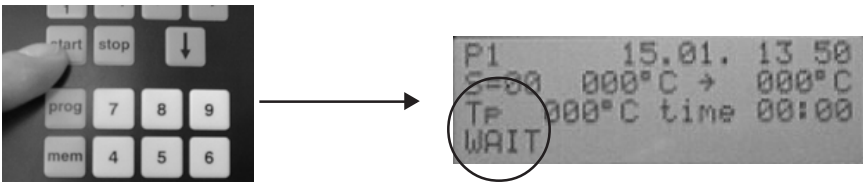


Activating a program

Entering start time

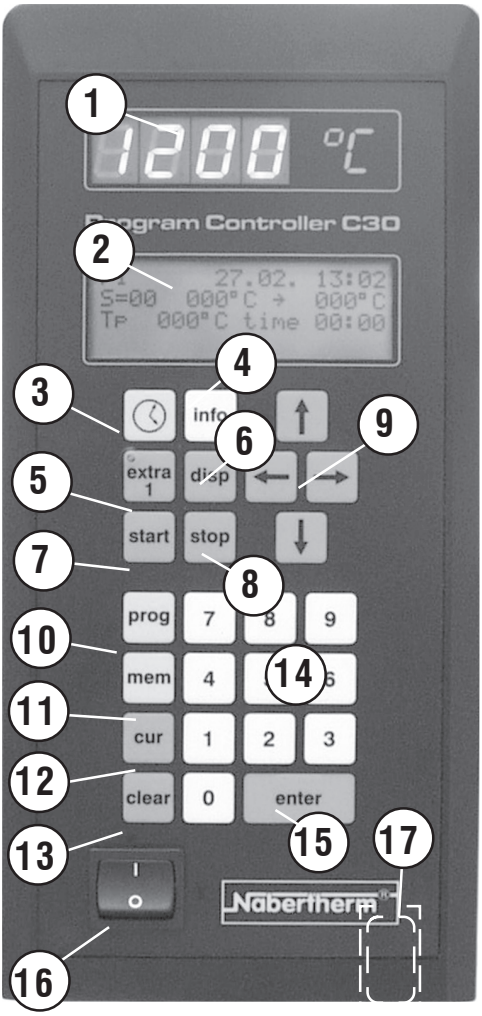


Starting a program



Contents

Control panel



1 Display **„temperature“**

2 Entering-Display

3 **„Date/time“** key

4 **„info“** key

5 **„extra 1“** key

6 **„display“** key

7 **„start“** key

8 „stop“ key

9 Cursor keys for entering program values

10 Program call key **(„prog“)**

11 Program memory key **(„mem“)**

12 **„cursor“** key

13 **„clear“** key

14 Numerical keys **„0-9“**

15 **„enter“** key

16 Rocker switch

17 Digital interface RS 422 (at the back side)

Features

The Controller C30 (more than 3.6 kW) or S30 (up to 3.6 kW) is an electronic temperature program controller which permits the precise control of your heat treatment processes.

The controller features:

- 9 programs, each with 18 segments which can be individually pro-grammed and stored
- An extra function which can be switched on during a process
- Automatic timer for programmable start time
- 4-line LCD display
- Programming of date and time
- Digital interface RS 422 for connection to a PC

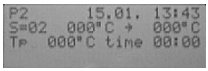
Safety

The controller is equipped with a number of electronic safety features. In the event of malfunction, the furnace switches off and a fault indication appears on the display. For more details see **“Fault Indications”** on page 17.

Switching on the controller

The controller is ready for operation when the rocker switch is switched on **“1”**.

The furnace temperature (in this case, e.g. 20°C) appears on the LED display.

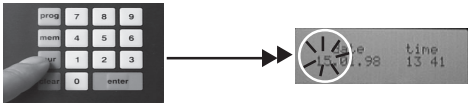


The program start display with information on the program last processed appears on the input display. For more details, refer to section **“Input display”** on Page 6.

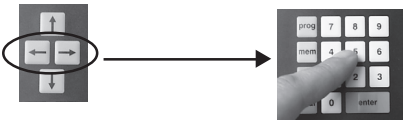
Entering date and time

Before entering a program, check the factory-set date and time.

Press key **date/time**, the factory-set date and time appear on the input display.



Wrong date or time?
Press **cur** key, the day entered appears on the input display under **date.**



With the **left/right** key select the figure you wish to alter and enter the desired figure with the numerical keys **0-9.**

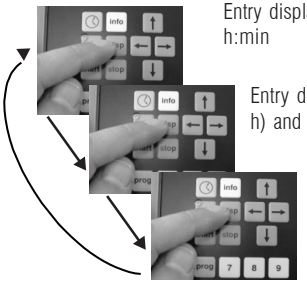
To confirm and store the values, press the **enter** key after each alteration.

Press the **date/time** or **disp** key to return to the program start display.

Input display

By pressing the **disp** key repeatedly you can call up several displays.

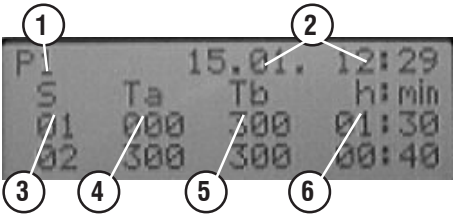
The following examples provide an overview of the various display possibilities and their function.



Entry display with h:min

Entry display with rate (°C/h) and dwell time in min

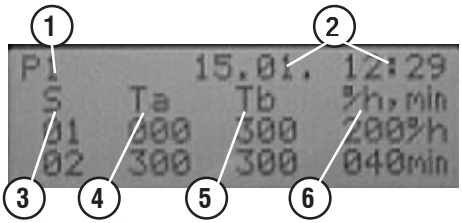
Program start display



Entry display with h:min

In this entry display you can enter the program values for heating up, cooling down, dwell time in **hours and minutes**

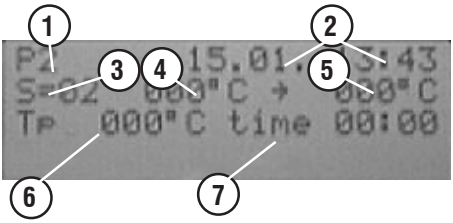
1 Current program number
2 Date/time of last program start
3 Segment number
4 Starting temperature of segment
5 End temperature of segment
6 Heating up, cooling down or dwell time of segment in **hours/minutes**



Entry display with rate (°C/h) and dwell time in min

When you wish the program to heat up at a certain rate, i.e. **°C/h (hours)**, select this entry display. The dwell time is entered here in **minutes** at the same time.

1 Current program number
2 Date/time of last program start
3 Segment number
4 Starting temperature of segment
5 End temperature of segment
6 Rate of segment in **°C/h** or dwell time of segment in **minutes**



Program start display

This display shows all essential infor-mation about the current program or the one last processed.

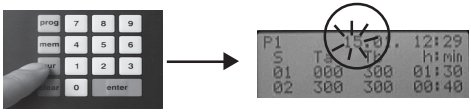
1 Current program number
2 Date/time of last program start
3 Segment number
4 Starting temperature of segment
5 End temperature of segment
6 Actual program setpoint value
7 Remaining segment time

Entering start time

The controller offers you the possibility of starting a program at any fixed time. This start time defines in day and time the desired program start time.

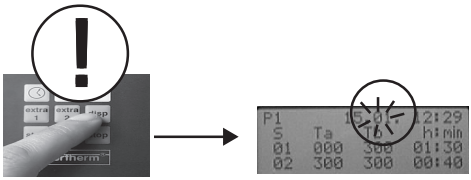
As the controller determines a delayed program start in accordance with the date and time of the integrated timer, please refer again to the section **"Entering date/ time"** on Page 6.

Select an input display with **disp** key (see Page 6).



Press the **cur** key, the day, month or hour/min flash on the input display.

Enter start date and time with numerical keys 0 - 9.



Press the enter key after entering each value. The cursor then jumps automatically to the next program segment.

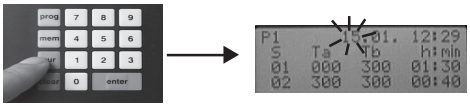
Entering a program

The controller is equipped with 9 programs, each with 18 segments which can be individually programmed and stored.

Setting of a program is allways done in one of the input displays. More in-formation look page 6, **„Input display"**.

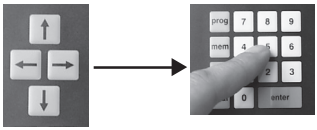
When programming a cooling ramp with post-heating function make sure to enter a segment time of at least 00:01 in the corresponding cooling segment.

Press the **disp** key you need out of the several displays.

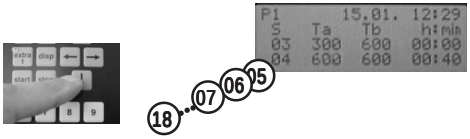


Press the **cur** key; the day, month or hour/min flash on the input display.

Enter start date and time with numerical keys **0-9**.



With the **left/right** or **up/down** keys you can directly select the position in the table desired and enter program values with the numerical keys **0-9**.



By pressing the **up/down** keys you can select segments not usually visible on the input display.

We recommend not to alter starting temperature value **Ta000** in **segment 1**.

Activating extra function

The controller offers an extra function* which can be switched on automatically or manually.

Switching on automatically:
Press the key extra 1 when programming in the segment (**Ta, Tb** or **h:min** or **°/h, min**) in which the function shall be activated.
The integrated LED lights up.

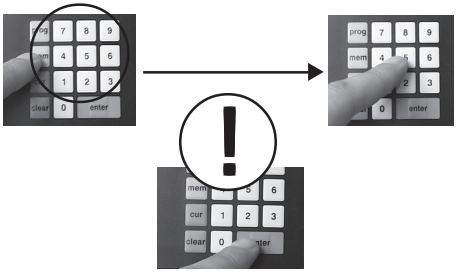
When programming the next segment, the function extra 1 is automatically deactivated and the LED extinguishes.

Switching on manually:
The function **extra 1** can be activated or deactivated at any time during the program cycle by switching it on/off manually.

At the end of the segment in which the function **extra 1** was switched on, the integrated LED extinguishes and the function is automatically deactivated.

* e.g. blower, acoustic signal. This special function must be an integrated part of the switchgear (available as an option)

Storing a program

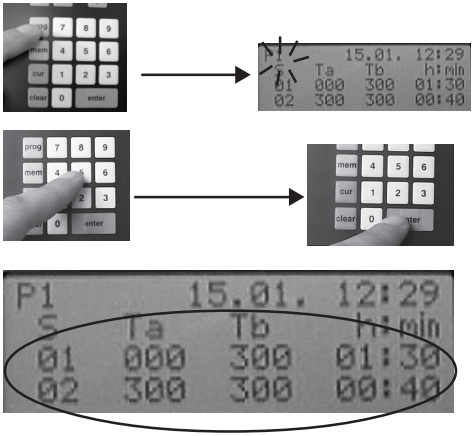


All program values entered can be stored in the memory of the program controller.

Press the mem key, select desired memory location with numerical keys **1-9** and press **enter.**

With that, it is possible to access the program values at any time.

Activating a program



When a program has been stored in one of the memory locations **1-9**, then this program can be retrieved again and again at any time.

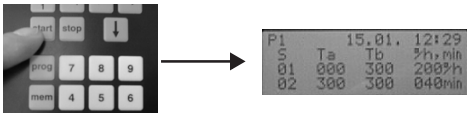
Press the **prog** key, the number of the program last processed flashes on the input display.

Enter the number of the program desired with the numerical keys **1-9** and press the **enter** key.

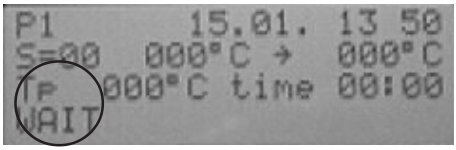
All program values stored appear on the input display.

Starting a program

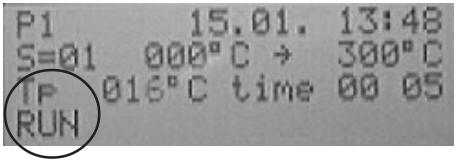
After the desired program has been called up, the program can be started.



Press the **start** key, the program start display appears on the input display.



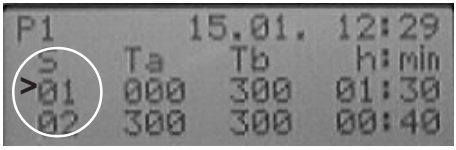
If you have entered a delayed program start (start time), the status **WAIT** appears on the program start display.



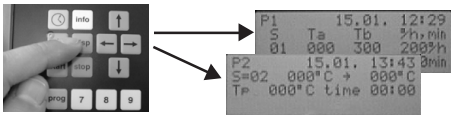
As soon as the start time has been reached the status **RUN** appears on the display and the program executes the program segments entered.

Overview of program cycle

All program values entered can be viewed at any time, i.e. even whilst a program is running.



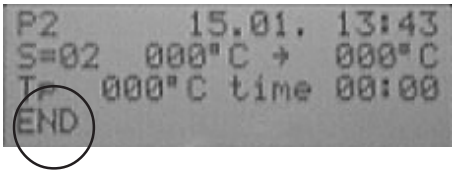
If the controller is switched into a running program, the symbol “>“ appears in front of the segment which is currently being executed.



With the **disp** key you can select the various displays in the input display even whilst a program is running.

Stopping a program

A program can be stopped automatically or manually.



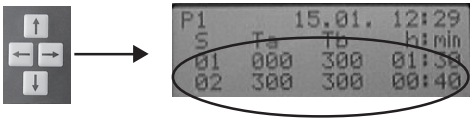
Program stop automatically:
When the program stops **automatically**, the program entered has been fully executed. The program start display appears **END**.

Program stop manually:
To stop a program manually press the stop key; the program start display appears **STOP**.

Attention:
At the end of the program all values entered remain stored.

Altering program cycles

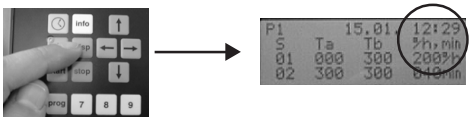
All program values can be altered individually at any time.



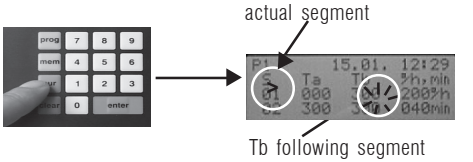
When entering a program:
Having called up the program that you wish to alter, move the cursor keys **left/right** or **up/down** on to the figure on the entry display that you wish to alter.

Enter the desired figures with the numerical keys **0-9**.

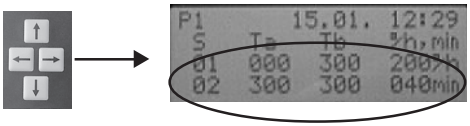
Press the **enter** key after each alteration to overwrite the old values and to store the new values in the memory (see section **"Storing a program"**).



During a running program:
With the **disp** key, select the entry display Rate (**°C/h**) and dwell time in **min** (see section **"Input display"** on Page 6).

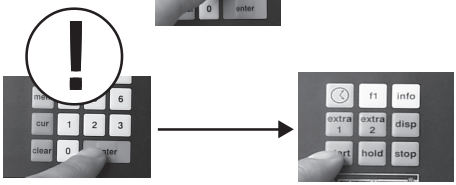


Press the **cur** key, the entered program value **Tb** of the following segment flashes.

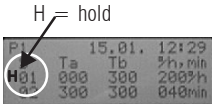


Move the cursor keys **left/right** or **up/down** on to the figure on the entry display that you wish to alter.

Enter the desired figures with the numerical keys **0-9**.



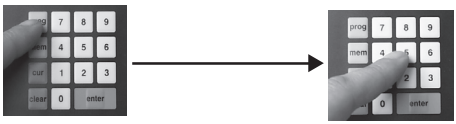
Press the **enter** key and the **start** key, the program is continued, processing the new values, and the program start display appears with status **RUN**. For a detailed explanation, see section **"What to do, when..."** on Page 21.



Note:
When you alter a running segment (">" in front of segment) the letter **"H"** (=hold) appears in front of this segment, as the program is halted until the **start** key is pressed again.

Clearing a program

You can clear a whole program to create memory space for a new program.

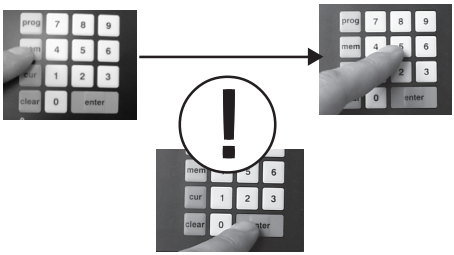


Call up the program you wish to clear. To do so, press the **prog** key and the relevant program number **(1-9).**

Press the **enter** key, the program appears on the input display with the entered values.

Make sure that this is the program you wish to clear.

Having checked this, press the **clear** key, all program values entered are set to **0** on the input display.

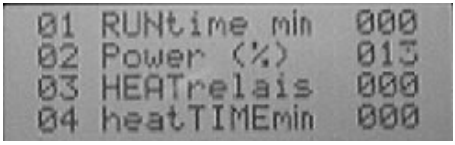


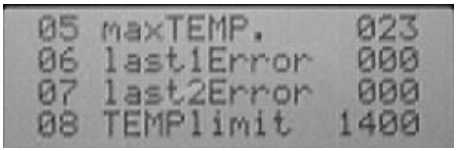
Press **mem** key, the relevant memory location 1-9 and the **enter** key, all values on the memory are cleared.

Checking informations

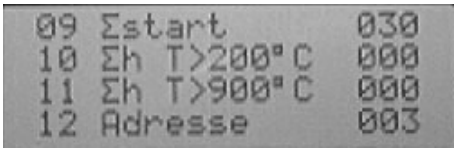
The controller also offers additional information which can be called up at any time, i.e. even during a running program.

Press the info key, the following information appears:





01 run time min
Time already processed in current program
02 power%
Current heating performance
03 heat relay
State of heating relay (1= ON, 0= OFF)
04 heat TIME min
Effective heating time of program
05 max TEMP
Maximum temperature reached during program
06 last1Error
Last fault indication
07 last2Error
Fault indication before last
08 TEMPlimit
Factory-set max. operating temperature of program controller
09 Σ start
Sum of all program starts

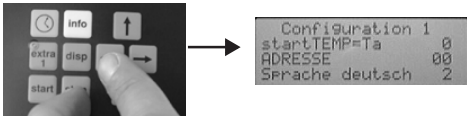


10 h T>200°C
Total operating time at furnace temperature over 200°C
11 h T>900°C
Total operating time at furnace temperature over 900°C
12 Address
Address of digital interface RS 422

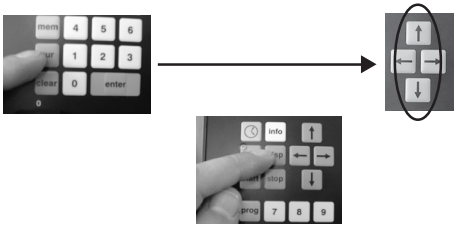
Note:
With the **up/down** keys you can call up information not usually visible on the input display.
Press **info** key to exit this area.

Altering configurations

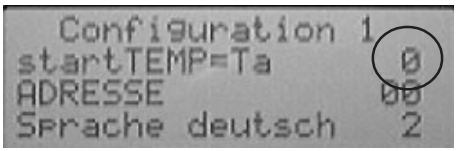
The controller is delivered in a standard configuration which you can alter to suit your individual requirements.



Press the **stop** key and keep it pressed. Then press the **left** key, any program running will be halted and the factory-set configuration (**Configuration 1**) appears on the input display.



To alter the set values, press the **cur** key. With the keys **up/down** you can select the figure you wish to alter. Press the **disp** key to exit this area.

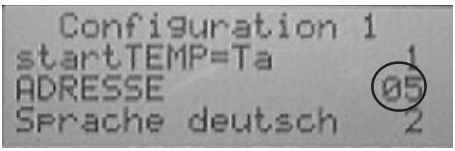


Start temperature=Ta 0
(Factory-set)
The function of this is that, regardless of the start temperature entered in **Segment 1**, the program always starts with the current actual temperature of the furnace.

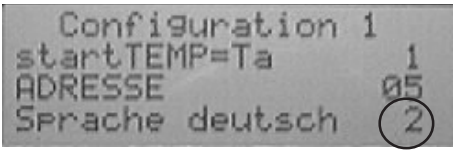
Start temperature=Ta 1
The program starts with the value entered in **Ta** of **segment 1**.

To alter the factory-set value, press the numerical key **1.**

Attention:
To utilize the residual heat of the furnace, the value **0** should not be altered.



Address (1 - 32)
Assignment of the digital interface **RS 422** is defined in the address. It must be ensured that the same address is selected as that on the PC connected . For further details, see the following section “Digital interface RS 485”.



Language of fault indication
English =01
German =02
French =03
Spanish =04

To define the desired language, press the relevant numerical key 1,2,3, or 4.

Digital interface RS 422

The controller is equipped with a digital interface **RS 422** on the back of the casing. This interface renders connection to a conventional PC possible. With the use of appropriate **control software**, all program features can be comfortably controlled and monitored even externally.

Further information on the digital interface **RS 485** and appropriate software for using a PC can be obtained from Nabertherm directly

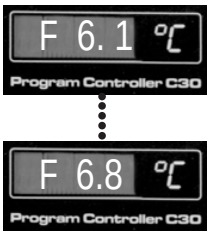
Fault indications

In the event of program controller malfunction, the furnace switches off automatically and a fault indication appears on the LED display temperature. This fault indication often facilitates the tracing and elimination of the fault.

The following fault indications may appear on the LED display, indicating a malfunction:

Fault indication **F3** appears when a fault in the temperature measuring circuit occurs. **"Fault thermocouple"** appears on the input display.
Possible cause:
- Thermocouple is defect
- Equalizing cable to thermocouple is defect

Fault indication **F4** appears when the thermocouple has been wrongly connected. **"Th.E reversed"** appears on the input display.
Cause:
- Thermocouple polarity reversed



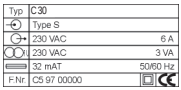
Fault indications **F6.1** to **F6.8** appear when a system fault in the controller occurs. **"System fault"** appears on the input display.
Possible cause:
- The controller is defect
- External power system disturbance

Attention:
When this fault indication appears, switch off the controller for a moment and then switch it on again. In most cases this will rectify the fault and the program will continue automatically.

Fault indication **F7** appears when the actual temperature is 50°C higher than the maximum operating temperature. This fault indication is triggered only when the furnace temperature has exceeded 700°C.**„Temperature too high“** appears on the input display.
Possible cause:
- Contactor defect

If it is not possible to eliminate the fault, please contact your customer service or call Nabertherm direct.

Furnace rating plate



Controller rating plate

To deal with the problem as fast as possible the following is always required:
- Fault indication shown on display
- Rating plate data (furnace and controller)

Technical data

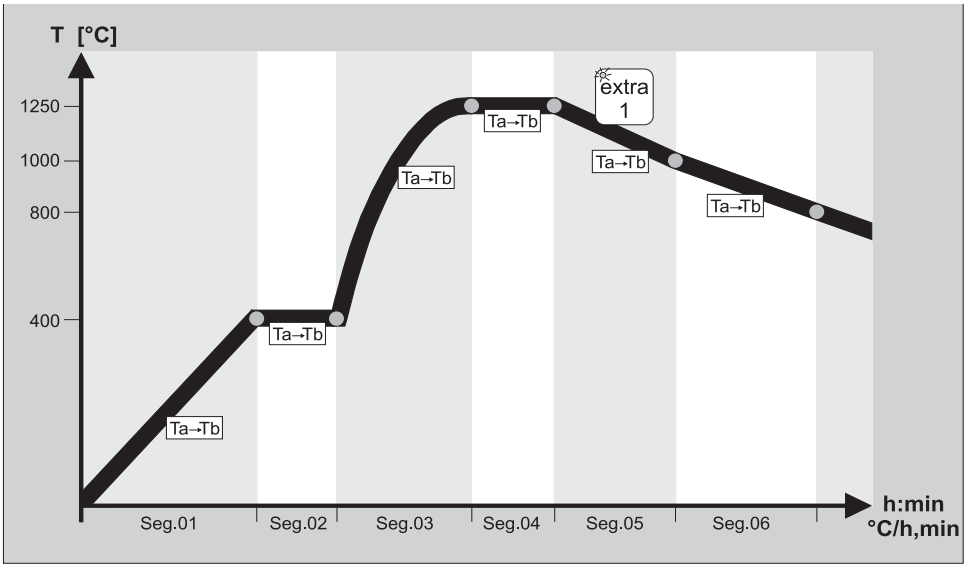
Tmax.	Set at works according to type of furnace
Measurement input:	Type S
Overvoltage category:	Class II
Environmental conditions:	5 °C - 40 °C in compliance with EN 60204, part 1 Humidity: 30% - 95%
Cleaning:	Switch unit off load, clean with damp cloth
Protection class:	C30: protection class 2 / totally insulated ⧈ S30: protection class 1 / PE termina ⏚
In the event of a power failure:	During the start delay time (wait): • program is continued Furnace temperature < 100 °C: • at < 4 sec = program is continued • at > 4 sec = program is aborted Furnace temperature > 100 °C and Temparature decrease < 20 °C: • program is continued Furnace temperature > 100 °C and Temperature decrease > 20 °C: • program is aborted
Calculatorical resulution of temperature gradient	in full minutes

Rating data

Type:	C30 / S30
Relay outputs:	C30: 230V - 6A (floating) S30: 230V - 16A
Supplay voltage:	230V - 50/60 Hz, 3,5 VA
Fusing:	C30: 40 mAT S30: 40 mAT

Program example

The following program consists of six program segments selected at random. Maximum 18 segments in one program are possible.



S 01	Ta	=	000 °C	After program start the furnace heats linearly from the current actual temperature (**Ta**) of the furnace to 400°C (**Tb**) within 6 hours at a rate of 66 **°C/h** .
	Tb	=	400 °C	
	time	=	6h:00min	
	rate	=	66 °C/h	
S 02	Ta	=	400 °C	On reaching 400 °C, the temperature is maintained for 30 min.
	Tb	=	400 °C	
	dwell time	=	0h:30min	
S 03	Ta	=	400 °C	As no heating-up time was defined in this segment, the furnace heats at full capacity from 400 °C (**Ta**) to 1250 °C (**Tb**). It is not possible to determine the rate as the heating-up time can vary considerably depending on the type and quantity of the charge as well as on the type of furnace employed.
	Tb	=	1250 °C	
	time	=	0h:00min	
	rate	=	---°C/h	

S 04	Ta	=	1250 °C	On reaching 1250 °C the temperature is maintained for 25 min.
	Tb	=	1250 °C	
	dwell time	=	0h:25min	
S 05	Ta	=	1250 °C	The furnace cools down linearly from 1250 °C (**Ta**) to 100°C (**Tb**) within 3 hours and 30 min. The function **extra 1** (e.g. blower) is switched on simultaneously.
	Tb	=	1000 °C	
	time	=	3h:30min	
	rate	=	71 °C/h	
S 06	Ta	=	1000 °C	Here the furnace cools down in 5 hours from 1000 °C (**Ta**) to 800 °C (**Tb**). The extra function was switched off automatically as soon as this segment was reached. At the end of the segment the furnace switches off and the status **END** appears in the program start display of the controller.
	Tb	=	800 °C	
	time	=	5h:00min	
	rate	=	40 °C/h	

What to do, when...

... you wish the program to start at some later date/ time?

Enter the desired start time on the input display and press the **start** key.

... you wish to prolong the dwell time in a running program?

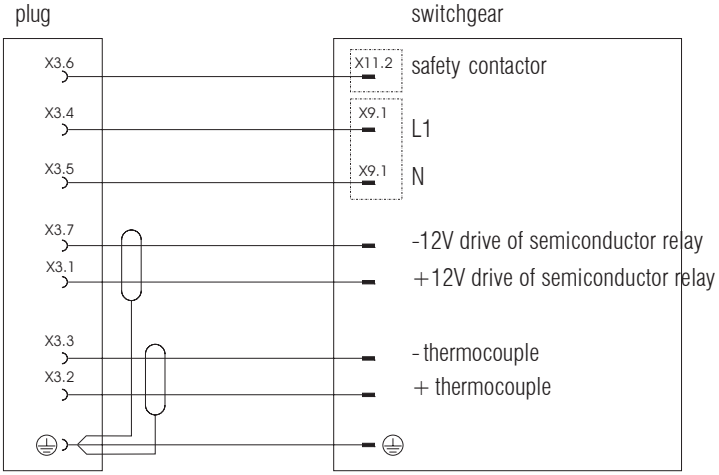
For example:
The dwell time that you wish to prolong was originally set at 30 min. 20 minutes of this time have already run. If you wish to prolong the dwell time by another 10 min for example, enter 20 min.
(**10 min remaining dwell time + 10 min prolongation of dwell time = 20 min**)

... a fault indication appears on the LED display?

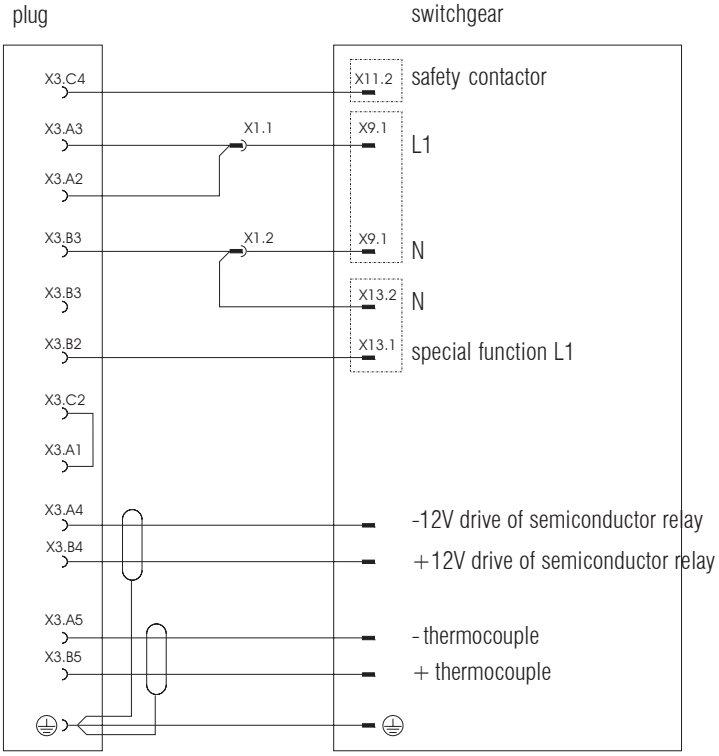
Check the status of the fault indication with the aid of the operating instructions. If the fault cannot be eliminated, note down the fault indication and the data on the rating plates of the furnace/controller and contact your customer service or call Nabertherm direct.

Circuit diagrams:

C 30/S10 for GF furnaces with semiconductor relay, 7-pin connector



C 30/S9 for semiconductor relay, 15-pin connector



Notes:

Reg.-Nr. B 2.22 (englisch), März 2004

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